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ALLELOPATHIC POTENTIAL OF SELECTED PLANT SPECIES OF GENUS ZANTHOXYLUM

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ABSTRACT

Present article investigates the allelopathic potential of Zanthoxylum armatum (ZAL), Zanthoxylum oxyphyllum (ZOL) and Zanthoxylum rhetsa (ZRL) leaves. For the screening of phytotoxic potential, five concentrations of crude ethanolic extract i.e. 1, 10, 50, 100 and 1000 ppm were selected in the bioassay against Brassica nigra seeds. 10 ppm concentration of alcoholic ZRL extract had showed least values of Germination Race and Response Index. Minimum Germination of Seedlings and Seed vigour was observed at 50 ppm concentration of crude ethanolic extract of ZRL. ZAL allelochemicals at 1000 ppm concentration was found most inhibitory for both Radicle and Plumule length. However, In case of ZOL allelochemicals, 1 ppm concentration of crude ethanolic extract was found most inhibitory for both Radicle & Plumule length and Germination % & Germination Race had showed strong correlation. The present findings have clearly demonstrated the significant potential of Zanthoxylum Genus towards the phytotoxic activity and might be used effectively as bio-herbicide for weeds control.

KEYWORDS: Allelopathic Potential, Brassica nigra Seeds, Germination Race, Response Index and Bio-herbicide

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INTRODUCTION

Weed control is a major problem in agriculture (Takemura *et al.*, 2013). Application of different chemicals in weed control (Louda *et al.*, 1997) is now-a-days limited due to their health hazards (Khuda *et al.*, 2012). Therefore, there is a need to shift focus towards those alternative controls that are economically viable and having minimum harmful effects (Ayaz *et al.*, 2014; Zeb *et al.*, 2014). The phenolic compounds (such as flavonoids and phenols) are reported as the most widely distributed toxic plant metabolites (Phytotoxins) (Qureshi *et al.*, 2014; Arowosegbe *et al.*, 2012) responsible for their toxicity in ecosystem (Qureshi *et al.*, 2014). Relatively few studies have been carried out on allelopathy of *Zanthoxylum* Genus (Patino *et al.*, 2012) using ecologically realistic methods and concentrations of allelochemicals.

MATERIALS AND METHODOLOGY

Zanthoxylum armatum (ZAL), *Zanthoxylum oxyphyllum* (ZOL) and *Zanthoxylum rhetsa* (ZRL) leaves were collected from Chungliyimsen village, District- Mokokchung, Nagaland (North-East India). Plant materials were cleansed with distilled water and allowed to dry for 15 days in dark. Thereafter, it was coarsely crushed using homogenizer and grinded mechanically of mesh size 1 mm. The powdered plant material was extracted successively with 70% Ethanol. After 48 hours, extracts were filtered by using muslin (cheese cloth) followed by Whatman filter paper No.1 and filtrates were evaporated to dryness and weighed. The crude extracts were stored

in air tight glass containers at 4°C till further analysis. All extracts were subsequently stored at -20 ^{0}C in deep freezer until bioassays were conducted. Solvents used in extraction and Reagents for phytochemical and phytotoxicity analysis were of pure analytical grade. Phytotoxicity activity of different species of *Zanthoxylum* was analysed using Petriplates assay (McLaughlin and Rogers, 1998) on *Brassica nigra* L. seeds. Following parameters were considered to analyse the phytotoxic potential of ethanolic crude extract of Zanthoxylum *species*: Germination Percentage, Percentage Inhibition of Root and Shoot Length, Germination Index (GI), Plumule and Radicle Length, Germination Race, Seed Vigour, Response Index, and Fresh and Dry weight Biomass.

RESULTS AND DISCUSSIONS

Phytotoxicity Bioassay of Crude Alcoholic Extract of *Zanthoxylum armatum* Leaves (ZAL) on *Brassica nigra* Seeds

1000 ppm concentration of crude ethanolic extract was found most inhibitory for both Radicle and Plumule length [Figure 1 (A)]. However, crude ethanolic extract of ZAL showed least inhibitory affect at 50 ppm concentration on both Plumule (81 mm) and Radicle length (136.57 mm) [Figure 1 (B)]. The Radicle and Plumule length in ZAL conferred strong positive correlation (r = 0.874) with R^2 value equals to 0.764. Germination percentage was found similar at 1 ppm, 10 ppm and 1000 ppm concentration of ZAL allelochemicals. Trend in Fresh weight and dry weight biomass were found in the same proportion as that of biometric characters, germinations indices and Seed vigour as well at different doses of crude ethanolic extract of ZAL.

Figure 1: (A)

Figure1: (B)

Figure 1: (C)

Figure 1: Effect of Different Concentrations of Crude Ethanolic Extract of ZAL on Biometric Characterization of *Brassica Nigra* Seeds. (A) 1000 Ppm Concentration of Crude Ethanolic Extract; (B) 50 Ppm Concentration of Crude Ethanolic Extract; (C) Control Sample

Phytotoxicity Bioassay of Crude Alcoholic Extract of *Zanthoxylum Oxyphyllum* Leaves (ZOL) on *Brassica Nigra* Seeds

The inhibitory effects of ZOL allelochemicals were more pronounced on Plumule length than on the Radicle

length. 1 ppm concentration of crude ethanolic extract was found most inhibitory for both Radicle and Plumule length [Figure 2 (A)]. Radicle and Plumule length increased with increase in concentration of ZOL allelochemicals except at 1000 ppm concentration. The Radicle and Plumule length in ZOL treated samples shows strong positive correlation. At 1 ppm and 10 ppm doses of ZOL allelochemicals [Figure 2 (A); [Figure 2 (B)], Germination % and Germination Race showed strong correlation. Trend in Fresh weight biomass increased with increase in doses of crude ethanolic extract of ZOL except at 1000 ppm while trend in dry weight biomass followed the same pattern except at 100 ppm and 1000 ppm doses.

Figure 2: (A)

Figure 2: (B)

Figure 2: (C)

Figure 2: Effect of Different Concentrations of Crude Ethanolic Extract of ZOL on Biometric Characterization of *Brassica Nigra* Seeds (A) 1 Ppm Concentration of Crude Ethanolic Extract; (B) 10 Ppm Concentration of Crude Ethanolic Extract; (C) Control Sample

Phytotoxicity Bioassay of Crude Alcoholic Extract of *Zanthoxylum rhetsa* Leaves (ZRL) on *Brassica nigra* Seeds

The inhibitory effects of ZRL allelochemicals were more pronounced on Plumule length than on the Radicle length. 100 ppm concentration of crude ethanolic extract was found most inhibitory for both Plumule and Radicle length [Figure 3 (A)], while 50 ppm concentration was found most inhibitory for Radicle length (93 mm) [Figure 3 (B)]. Radicle length proportionally decreases with increase in concentration of ZRL allelochemicals except at 100 ppm and 1000 concentrations. Germination Race increases with increase in dose of ZRL allelochemicals except at 1 and 100 ppm. Correlation of Seed vigour is much stronger with Radicle length (r= 0.9944) than Plumule length (r=0.9187). Trend in Fresh weight biomass were found in the same proportion as that of Plumule length at different doses of crude ethanolic extract of ZRL except at 100 ppm concentration.

Figure 3: (A)

Figure 3: (B)

Figure 3: (C)

Figure 3: Effect of Different Concentrations of Crude Ethanolic Extract of ZOL on Biometric Characterization of *Brassica Nigra* Seeds. (A) 100 ppm Concentration of Crude Ethanolic Extract; (B) 50 ppm Concentration of Crude Ethanolic Extract; (C) Control Sample

CONCLUSIONS

Allelopathic influence of *Zanthoxylum armatum* (ZAL), *Zanthoxylum oxyphyllum* (ZOL) and *Zanthoxylum rhetsa* (ZRL) leaves were tested on *Brassica nigra* seeds. The inhibitory effects of ZAL, ZOL, and ZRL allelochemicals were more pronounced on Plumule length than on the Radicle length. 10 ppm concentration of ZRL allelochemicals concentration showed least values of Germination Race and Response Index. Minimum Germination of Seedlings and Seed vigour was observed at 1000 ppm concentration of crude ethanolic extracts of ZRL. In conclusion, the present study demonstrates significant allelopathetic potentials of crude ethanolic extracts of ZRL at 10 ppm and 50 ppm concentrations. Results have clearly supported the potential phytotoxic activity of Genus *Zanthoxylum*. Thus, it is taken into consideration that the selected species of *Zanthoxylum* Genus preferentially have some useful influences in agriculture. However, present findings underline the importance and necessity of further phytotoxicity investigations coupled with extensive field trials for exploration of different *Zanthoxylum* species in the field of sustainable agriculture and plant growth management.

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